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(54) **Automatic machine for the production of rounded bevels at the corners of flat sheets**

Automatische Vorrichtung zum Herstellen runder Abstumpfungen an Ecken von Platten

Machine automatique pour la production de chanfreins ronds aux angles de feuilles plats

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Description

The present invention relates to an automatic machine for the production of rounded and/or substantially rectilinear bevels at the corners of flat slabs of various materials.

As is known, in the processing of flat slabs of various materials, finishing of both the edges of the slab and the corners thereof is often required. In particular in the processing of slabs of glass it is necessary to carry out grinding of the edges and removal of the sharp corners which constitute primary points for the start of breakage of the slab.

An example of equipment known in the art is disclosed into EP-A-126 038 that shows an automatic machine according to the precharacterizing part of claim 1.

The technical problem which is posed, therefore, is that of providing a machine capable of removing a flat slab, particularly a slab of glass, from either a loader or a continuous production line, and carrying out finishing of the sharp corners by rectilinear bevelling or by rounding.

Within the context of such problem a further need is to carry out rounding and bevelling with a preset radius of curvature in an automatic manner and without limitations, thus making it possible in particular to perform with great ease and rapidity rounding with a different radius of curvature even on the same slab without the need for complex machine tooling operations.

Said results are obtained with the present invention, which provides an automatic machine for the production of rounded and/or substantially rectilinear bevels at the corners of flat slabs according to the characteristics of claim 1.

Further details may be obtained from the following description, given with reference to the attached drawings which show:

In figure 1: the machine according to the invention viewed from the front, and

In figure 2: the machine in fig. 1 viewed from the side.

As illustrated in the figures, the machine according to the invention comprises a support frame 10 which has rotatably connected to it a conveying device 20 comprising a counterframe 21 which is hinged at the top to the frame 10 by means of hinges 11 with a horizontal axis and fastened at the bottom to moving rods 2a of cylinders 2 fastened to a crosspiece 12 of the frame 10 in such a way as to keep the entire conveying device 20 tilted back with respect to an ideal front vertical plane of the machine and rotatable about the hinges 11 from a lower position to an upper position.

The lower end of the counterframe 21 has attached to it idle rollers 22 arranged with their axis perpendicular to the plane of the counterframe 21 and designed to form the support for the lower edge 3a of a slab of glass 3 supported on a pair of conveyor belts 23 forming a closed loop between drive rolls 23a, keyed onto a shaft 23b which is made to rotate by a motor 23c, and rolls 23d keyed onto an idle shaft 23e.

In this manner the glass slab 3 is kept tilted, being positioned by gravity with its flat surface resting on the conveyor belts 23 and with the lower edge 3a resting on the idle rollers 22, and may be made to advance in the feeding direction "A" driven by the belts 23 and rolling on the idle rollers 22.

As also illustrated more clearly below, said lower edge 3a of the slab 3, coinciding with an ideal tangent to the rollers 22, constitutes the zero reference line of the machine.

Said feeding is furthermore effected by keeping the entire conveying device lowered with respect to a holding device 30 (described below) and causing translation of the slab 3 as far as the stop element 40 integral with the conveying device 20, relative to which it may still move in a direction parallel to the direction of travel and in either sense, in order to determine the stopping position of the front edge 3b of the slab 3 and consequently also, as will emerge more clearly below, the radius of curvature of the final bevel.

At the zone of stoppage of the slab 3 and above the latter the machine is provided with a device 30 for holding and handling the said slab, substantially consisting of a flat flange 31 integral with a support 32b keyed onto a shaft 32a, operated in rotation by a pneumatic rotating device 32 mounted on the frame 10, relative to which the entire holding device 30 may be made to perform a translatory movement via an actuator 34 in a direction perpendicular to the feeding direction A, with displacements measurable with respect to a fixed reference 33, thus causing translation of the axis of rotation 32a from/to the zero line coinciding with the lower edge 3a of the slab 3.

The lower surface of the flange 31 furthermore has applied to it abutting spacers 34 and suction pads 35 placed under a vacuum using means which are known and therefore not illustrated.

The shaft 32a of the rotating device 32 is substantially perpendicular to the plane of the slab 3, and the rotation of the shaft itself, controlled by the associated device 32, causes the controlled rotation of the flange 31 and therefore of the slab 3 attached thereto by the suction pad 35.

Still in the area of stoppage of the slab 3 there is the cutting tool, in the example consisting of a grinding wheel 50 made to rotate by the shaft 51a of a motor 51 which is hinged, via pins 52, to vertical supporting flanges integral with a lower crosspiece 13 of the frame 10.

The motor 51 may be made to rotate about said pins 52 by a pneumatic cylinder 52a in order to obtain the rotation of the motor 51 from a rest position, with the grinding wheel 50 at a distance from the lower edge 3a

of the slab 3, to a micrometrically adjustable working position, with the grinding wheel close to said edge 3a.

Downstream of the slab holding and handling device there is also provided an unloading device 60 for removing the slab 3 upon completion of processing and substantially consisting of a pair of belts 61 arranged parallel to the feeding direction and forming a closed loop between drive rolls 61a, keyed onto a shaft 61b perpendicular to the feeding direction and operated by a motor 61c, and rolls 61c keyed onto an idle shaft 61e.

Operation of the machine is as follows: initially the conveying device 20 is in the lowered position (as shown in broken lines in fig. 2) and the grinding wheel 50 is in the rest position at a distance from the working line substantially consisting of an ideal tangent to the idle rollers 22, said tangent also substantially constituting the zero line relative to which positioning of the various moving devices of the machine is determined in order to obtain the desired radii of curvature for rounding.

Once the conveying device 20 has been started up, the incoming slab 3 is made to advance as far as the stop element 40 which is previously positioned at a predetermined distance from the axis of rotation 32a of the device 30 against which it stops; at this point the cylinders 2 cause rotation of the conveying device 20 about the hinges 11 thus moving the counterframe 21 into the raised position, and the slab 3 is correspondingly brought up against the spacers 34, while the suctions pads 35, placed under a vacuum, keep the slab attached to the holding device 30.

While the conveying device is lowered again to allow the feeding of a further slab of glass, the grinding wheel 50 is kept in rotation by the motor 51 and made to rotate by the pneumatic cylinder 52a into the working position, with the external profile resting on the lower edge 3a of the slab 3 coinciding with the zero line. At this point, the holding device 30 is made to rotate by the device 32, thus causing the movement of the slab 3 with respect to the grinding wheel 50 and therefore execution of the desired rounding.

Upon completion of rotation, the suction pads 35 release the slab 3, which falls onto the unloading device 60 by means of which it is removed from the machine for subsequent processing as required.

As is clear, the radius of curvature of rounding is determined by the dual adjustment in the longitunal direction (that is, parallel to the travel direction) of the element 40 which stops the front edge 3b of the slab 3, and by the adjustment, in the direction transverse to the feeding direction, of the position of the axis of rotation 32a of the holding device 30 with respect to the fixed zero line which, as already stated, is constituted by the tangent to the rollers 22 on which the lower edge 3a of the slab 3 rests.

More particularly, the symmetrical adjustment of said references will determine a position of the centre of the radius of curvature lying on the bisector of the angle determined by the lower edge 3a and the front edge 3b of the slab, with consequent symmetrical rounding. However, where the adjustment of the two references is asymmetrical, the centre of the radius of curvature would be outside said bisector, resulting in asymmetrical rounding.

It must also be pointed out that by positioning the centre of rotation 32a of the holding device 30 in the position furthest removed from the zero line in the transverse direction and at the same time moving the profile of the grinding wheel 50 away from the zero line itself by means of micrometric adjustment of the cylinder 52a, a radius of curvature is determined such that rounding is approximated with a substantially rectilinear bevel.

Moreover, the position of the centre of rotation in the vicinity of the profile of the grinding wheel makes it possible to obtain a highly accurate radius of curvature with the rectilinear edge of the slab.

It is therefore clear that with the machine according to the invention it is possible to perform rounding and bevels with a preset radius of curvature in an automatic manner and without limitations, it being possible in particular to perform, with great ease, rounding with different radii of curvature even on the same slab by simply adjusting the position of the stop element 40 and the axis of the shaft 32a causing rotation of the holding device 30, or to obtain rounding of equal radius on slabs 3 of different dimensions without the need for any adjustment of the positioning of the various devices of the machine.

Furthermore, by arranging in series four machines according to the invention, it is possible to operate in a continuous cycle on the four corners of the slab with equal or different rounding radii.

Many variants may be included as regards the realization of the parts which make up the invention without thereby departing from the scope of protection of the present patent as defined in the claims which follow. In particular, the pneumatic drives may be replaced by electric motors which can be operated by means of digital control devices and the like.

Claims

1. An automatic machine for the production of rounded and/or substantially rectilinear bevels at the corners of flat slabs (3), comprising:

   a fixed frame (10);
   a conveying device (20) for supporting and translating a slab (3);
   means (40) for stopping the feeding of said slab (3);
   a holding device (30) for holding said slab (3), said holding device being hinged to said fixed frame (10) about an axis, perpendicular to the plane of said slab (3), about which is capable to rotate;

a working tool (50) whose axis of rotation (32a) is rotatably connected to the fixed frame (10), and in relation to which it is pivotable via associated means (52, 52a); and

an unloading device (60) for unloading said slab (3) upon completion of processing;

characterized in that

said conveying device (20) is hinged to said fixed frame (10) of said machine about an axis parallel to the direction of feeding;

the axis of rotation (32a) of the holding device (30) is translatable into programmable positions perpendicular to a reference line parallel to the lower edge (3a) of the slab (3) and said stopping means (40) are translatable into programmable positions parallel to the direction of feeding and relative to the axis of rotation (32a) of the holding device so as to establish the desired radius of curvature.

2. An automatic machine for the production of rounded bevels according to claim 1, characterized in that said supporting and translating device comprises a counterframe (21) rotatably connected to the fixed frame (10) via hinges (11) with a horizontal axis and capable of being operated in rotation from a first lower position into a second upper position by means of actuators (2, 2a) interposed between the fixed frame (10) and the counterframe (21), said counterframe having moreover integral with it means (23) for conveying the slab in the feeding direction (A) and means for supporting the lower edge of the slab itself.

3. An automatic machine for the production of rounded bevels according to claim 1, characterized in that said means for conveying the slab are substantially composed of a plurality of belts (23) forming a closed loop between drive rolls (23a) and idle rolls (23d) keyed onto respective shafts (23b, 23d) integral with the counterframe (21) and with an axis transverse to the direction of feeding.

4. An automatic machine for the production of rounded bevels according to claim 1, characterized in that said means for supporting the lower edge (3a) of the slab (3) are composed of idle rollers (22) attached to the counterframe (21) and with an axis of rotation perpendicular to the plane of the slab (3).

5. An automatic machine for the production of rounded bevels according to claim 1, characterized in that said means for stopping feeding are substantially composed of an abutting element (40) integral with the conveying means (20) and translatable with respect to the latter in a direction parallel to the direction of feeding and in either sense, said abutting element constituting the end of travel of the front edge (3b) of the slab (3).

6. An automatic machine for the production of rounded bevels according to claim 1, characterized in that said means for holding the slab (3) are substantially composed of a flat flange (31) provided on the lower side with abutting means (34) and means (35) for retaining the said slab and being attached on the upper side to a shaft (32a) which can be operated in rotation by means of an actuator (32).

7. An automatic machine for the production of rounded bevels according to claim 1, characterized in that said working tool is a grinding wheel (5) actuated by a motor (51), the rotational shaft of which may be moved from a first rest position, with the grinding wheel at a distance from the edge of the slab, into a second working position, with the grinding wheel close to the edge of the slab.

8. An automatic machine for the production of rounded bevels according to claims 1 and 7, characterized in that the distance of the grinding wheel (50) from the edge of the slab (3) in the working position may be adjusted micrometrically by means of controllable actuators (52a).

9. An automatic machine for the production of rounded bevels according to claim 1, characterized in that said translatory movement of the axis of rotation (32a) of the holding device (30) is performed by means of a controllable actuator (34) interposed between the fixed frame (10) and the support (34) of the holding device itself.

Patentansprüche

1. Eine automatische Maschine für die Herstellung von abgerundeten und/oder im wesentlichen geradlinigen Abschlägungen an den Ecken von flachen Platten (3), aufweisend:

einen festen Rahmen (10);

eine Fördereinrichtung (20) zum Tragen und Verschieben einer Platte (3);

eine Einrichtung (40) zum Anhalten der Zuführung der genannten Platte (3);

eine Halteeinrichtung (30) zum Halten der genannten Platte (3), wobei die genannte Halteeinrichtung an dem genannten festen Rahmen (10) um eine Achse schwenkbar angelenkt ist, welche zu der Ebene der genannten Platte (3) rechtwinklig ist, wobei die genannte Halteeinrichtung um diese Achse drehbar ist;

ein Bearbeitungswerkzeug (50), dessen Drehachse (32a) mit dem festen Rahmen (10) drehbar verbunden ist, in Bezug auf welchen das Bearbeitungswerkzeug (50) durch zugeordnete Mittel (52, 52a) drehbar ist; und

eine Entladeeinrichtung (60) zum Entladen der genannten Platte (3) nach Durchführung der Bearbeitung;
dadurch gekennzeichnet, daß

die genannte Fördereinrichtung (20) an dem genannten festen Rahmen (10) der genannten Maschine um eine parallel zu der Richtung der Zuführung verlaufende Achse schwenkbar angelenkt ist;

die Drehachse (32a) der Halteeinrichtung (30) in programmierbare Positionen rechtwinklig zu einer Bezugslinie verschiebbar ist, welche zu dem unteren Rand (3a) der Platte (3) parallel ist, und die genannte Einrichtung (40) zum Anhalten in programmierbare Positionen parallel zu der Richtung der Zuführung und relativ zu der Drehachse (32a) der Halteeinrichtung verschiebbar ist, um so den erwünschten Krümmungsradius einzustellen.

2. Eine automatische Maschine für die Herstellung von abgerundeten Abschrägungen nach Anspruch 1, **dadurch gekennzeichnet,** daß die genannte Einrichtung zum Tragen und Verschieben einen Gegenrahmen (21) aufweist, welcher mit dem festen Rahmen (10) über Scharniere (11) mit einer horizontalen Achse drehbar verbunden und dazu befähigt ist, in Drehung von einer ersten, unteren Position in eine zweite, obere Position mit Hilfe von Betätigern (2, 2a) betrieben zu werden, welche zwischen den festen Rahmen (10) und den Gegenrahmen (21) dazwischengesetzt sind, wobei der genannte Gegenrahmen ferner mit ihm einstückig verbundene Mittel (23) zum Fördern der Platte in der Zuführrichtung (A) und Mittel zum Tragen des unteren Randes der Platte selbst aufweist.

3. Eine automatische Maschine für die Herstellung von abgerundeten Abschrägungen nach Anspruch 1, **dadurch gekennzeichnet**, daß die genannten Mittel zum Fördern der Platte im wesentlichen aus einer Mehrzahl von Bändern (23) zusammengesetzt sind, welche eine geschlossene Schleife zwischen Antriebsrollen (23a) und nicht angetriebenen Rollen (23d) bilden, wobei diese Rollen (23a, 23d) auf entsprechenden Wellen (23b, 23d) aufgekeilt sind, die mit dem Gegenrahmen (21) einstückig sind und mit einer quer zu der Richtung der Zuführung verlaufenden Achse versehen sind.

4. Eine automatische Maschine für die Herstellung von abgerundeten Abschrägungen nach Anspruch 1, **dadurch gekennzeichnet**, daß die genannten Mittel zum Tragen des unteren Randes (3a) der Platte (3) aus nicht angetriebenen Rollen (22) zusammengesetzt sind, die an dem Gegenrahmen (21) angebracht sind und mit einer Achse der Drehung rechtwinklig zu der Ebene der Platte (3) versehen sind.

5. Eine automatische Maschine für die Herstellung von abgerundeten Abschrägungen nach Anspruch 1, **dadurch gekennzeichnet**, daß die genannte Einrichtung zum Anhalten der Zuführung im wesentlichen aus einem mit der Fördereinrichtung (20) einstückigen Anschlagelement (40) bestellt und in Bezug auf die letztere in einer Richtung parallel zu der Richtung der Zuführung und in beiden Sinnen verschiebbar ist, wobei das genannte Anschlagelement das Ende der Bahn des vorderen Randes (3b) der Platte (3) bildet.

6. Eine automatische Maschine für die Herstellung von abgerundeten Abschrägungen nach Anspruch 1, **dadurch gekennzeichnet**, daß die genannte Einrichtung zum Halten der Platte (3) im wesentlichen aus einem flachen Flansch (31) besteht, der an der unteren Seite mit einer Anschlageinrichtung (34) und einer Einrichtung (35) zum Zurückhalten der genannten Platte versehen ist und an der oberen Seite an einer Welle (32a) angebracht ist, welche mit Hilfe eines Betätigers (32) in Drehung betrieben werden kann.

7. Eine automatische Maschine für die Herstellung von abgerundeten Abschrägungen nach Anspruch 1, **dadurch gekennzeichnet**, daß das genannte Bearbeitungswerkzeug eine Schleifscheibe (5) ist, die durch einen Motor (51) betätigt wird, dessen Rotationswelle von einer ersten Ruheposition, wobei sich die Schleifscheibe in einem Abstand von dem Rand der Platte befindet, in eine zweite Bearbeitungsposition bewegt werden kann, wobei sich die Schleifscheibe nahe an dem Rand der Platte befindet.

8. Eine automatische Maschine für die Herstellung von abgerundeten Abschrägungen nach Ansprüchen 1 und 7, **dadurch gekennzeichnet**, daß der Abstand der Schleifscheibe (50) von dem Rand der Platte (3) in der Bearbeitungsposition mit Hilfe von steuerbaren Betätigern (52a) mikrometrisch verstellt werden kann.

9. Eine automatische Maschine für die Herstellung von abgerundeten Abschrägungen nach Anspruch 1, **dadurch gekennzeichnet**, daß die genannte Verschiebebewegung der Drehachse (32a) der Hal-

teeinrichtung (30) mit Hilfe eines steuerbaren Betätigers (34) ausgeführt wird, der zwischen dem festen Rahmen (10) und der Abstützung (34) der Halteeinrichtung selbst angeordnet ist.

Revendications

1. Une machine automatique pour la production de chanfreins ronds et/ou sensiblement rectilignes aux angles de feuilles plates (3), comprenant :

   un bâti fixe (10) ;
   un dispositif de transport (20) pour supporter et déplacer une feuille (3) en translation ;
   des moyens (40) d'arrêt de l'alimentation de ladite feuille (3) ;
   un dispositif de maintien (30) pour maintenir ladite feuille (3), ledit dispositif de maintien étant articulé audit bâti fixe (10) autour d'un axe, perpendiculaire au plan de ladite feuille (3), autour duquel il peut tourner ;
   un outil de travail (50) dont l'axe de rotation (32a) est relié de manière rotative au bâti fixe (10), et en relation duquel il peut pivoter par l'intermédiaire de moyens associés (52, 52a) ; et
   un dispositif de déchargement (60) pour décharger ladite feuille (3) lors de la fin du traitement ;
   caractérisée en ce que
   ledit dispositif de transport (20) est articulé audit cadre fixe (10) de ladite machine autour d'un axe parallèle à la direction d'alimentation ; l'axe de rotation (32a) du dispositif de maintien (30) peut être déplacé en translation dans des positions programmables perpendiculaires à une ligne de référence parallèle au bord inférieur (3a) de la feuille (3) et lesdits moyens d'arrêt (40) peuvent être déplacés en translation dans des positions programmables parallèles à la direction d'alimentation et par rapport à l'axe de rotation (32a) du dispositif de maintien de manière à établir le rayon de courbure désiré.

2. Une machine automatique pour la production de chanfreins ronds selon la revendication 1, caractérisée en ce que ledit dispositif de support et de translation comprend un contre-bâti (21) relié de manière rotative au bâti fixe (10) par l'intermédiaire de charnières (11) à axe horizontal et capable d'être actionné en rotation depuis une première position inférieure jusqu'à une seconde position supérieure au moyen de leviers (2, 2a) interposés entre le bâti fixe (10) et le contre-bâti (21), ledit contre-bâti présentant en outre montés de manière solidaire avec ce dernier des moyens (23) pour transporter la feuille dans la direction d'alimentation (A) et des moyens pour supporter le bord inférieur de la feuille elle-même.

3. Une machine automatique pour la production de chanfreins ronds selon la revendication 1, caractérisée en ce que lesdits moyens pour transporter la feuille sont sensiblement composés d'un ensemble de ceintures (23) formant une boucle fermée entre des rouleaux d'entraînement (23a) et des rouleaux fous (23d) calés sur des arbres respectifs (23b, 23d) solidaires du contre-bâti (21) et présentant un axe transversal à la direction d'alimentation.

4. Une machine automatique pour la production de chanfreins ronds selon la revendication 1, caractérisée en ce que lesdits moyens pour supporter le bord inférieur (3a) de la feuille (3) sont composés de rouleaux fous (22) fixés au contre-bâti (21) et présentant un axe de rotation perpendiculaire au plan de la feuille (3).

5. Une machine automatique pour la production de chanfreins ronds selon la revendication (1), caractérisée en ce que lesdits moyens d'arrêt de l'alimentation sont sensiblement composés d'un élément de butée (40) solidaire des moyens de transport (20) et pouvant être déplacé en translation par rapport à ces derniers dans une direction parallèle à la direction d'alimentation et dans l'un ou l'autre sens, ledit élément de butée constituant la fin du trajet du bord avant (3b) de la feuille (3).

6. Une machine automatique pour la production de chanfreins ronds selon la revendication 1, caractérisée en ce que lesdits moyens de maintien de la feuille (3) sont sensiblement composés d'une bride plate (31) présentant sur le côté inférieur des moyens de butée (34) et des moyens (35) pour retenir ladite feuille et étant fixés sur le côté supérieur d'un arbre (32a) qui peut être actionné en rotation au moyen d'un vérin (32).

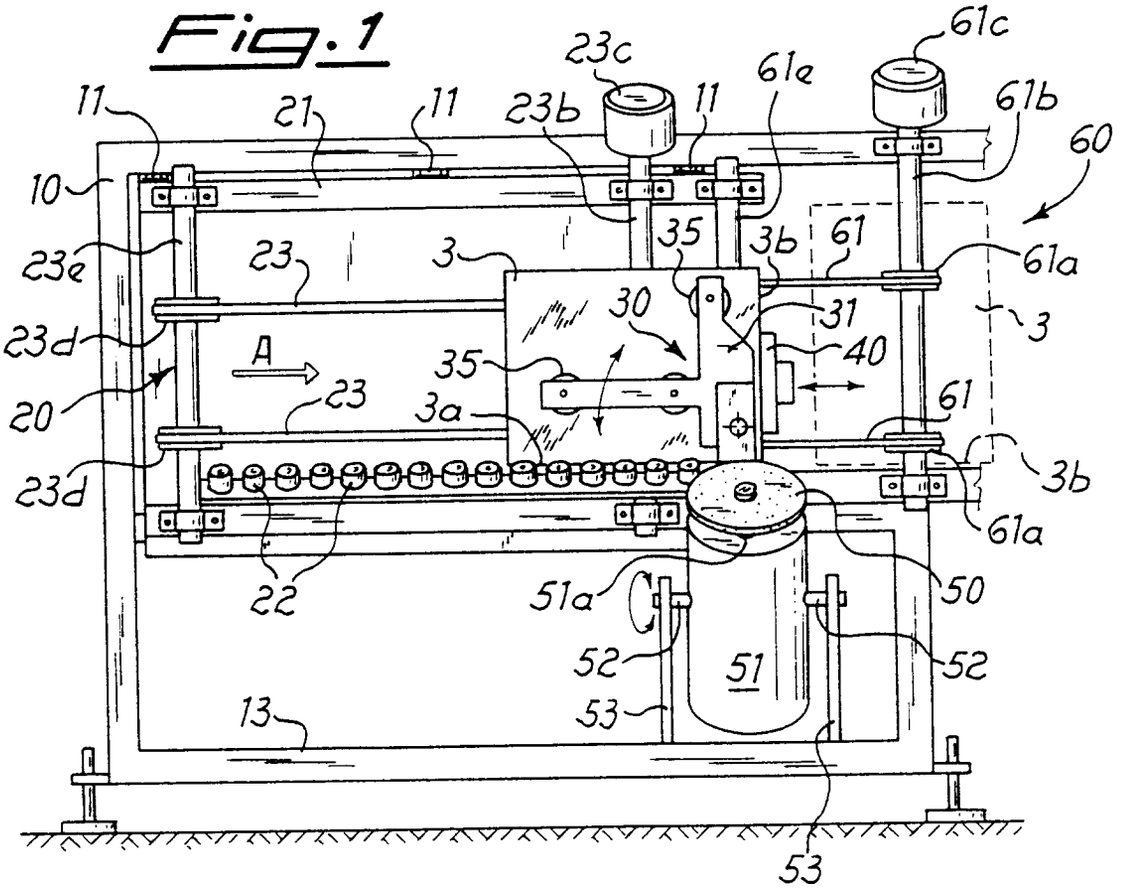
7. Une machine automatique pour la production de chanfreins ronds selon la revendication 1, caractérisée en ce que ledit outil de travail est une roue de meulage (5) actionnée par un moteur (51), dont l'arbre de rotation peut être déplacé depuis une première position de repos, avec la roue de meulage à une certaine distance du bord de la feuille, vers une seconde position de travail avec la roue de meulage près du bord de la feuille.

8. Une machine automatique pour la production de chanfreins ronds selon les revendications 1 et 7, caractérisée en ce que la distance de la roue de meulage (50) par rapport au bord de la feuille (3) dans la position de travail peut être réglée de manière micrométrique au moyen de vérins pou-

vant être commandés (52a).

9. Une machine automatique pour la production de chanfreins ronds selon la revendication 1, caractérisée en ce que ledit mouvement de translation de l'axe de rotation (32a) du dispositif de maintien (30) est effectué au moyen d'un vérin (34) pouvant être commandé, interposé entre le bâti fixe (10) et le support (34) du dispositif de maintien lui-même.

Fig.1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61e
61b
11
21
11
23b
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3b
61
61a
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3
30
31
3
23d
A
35
40
20
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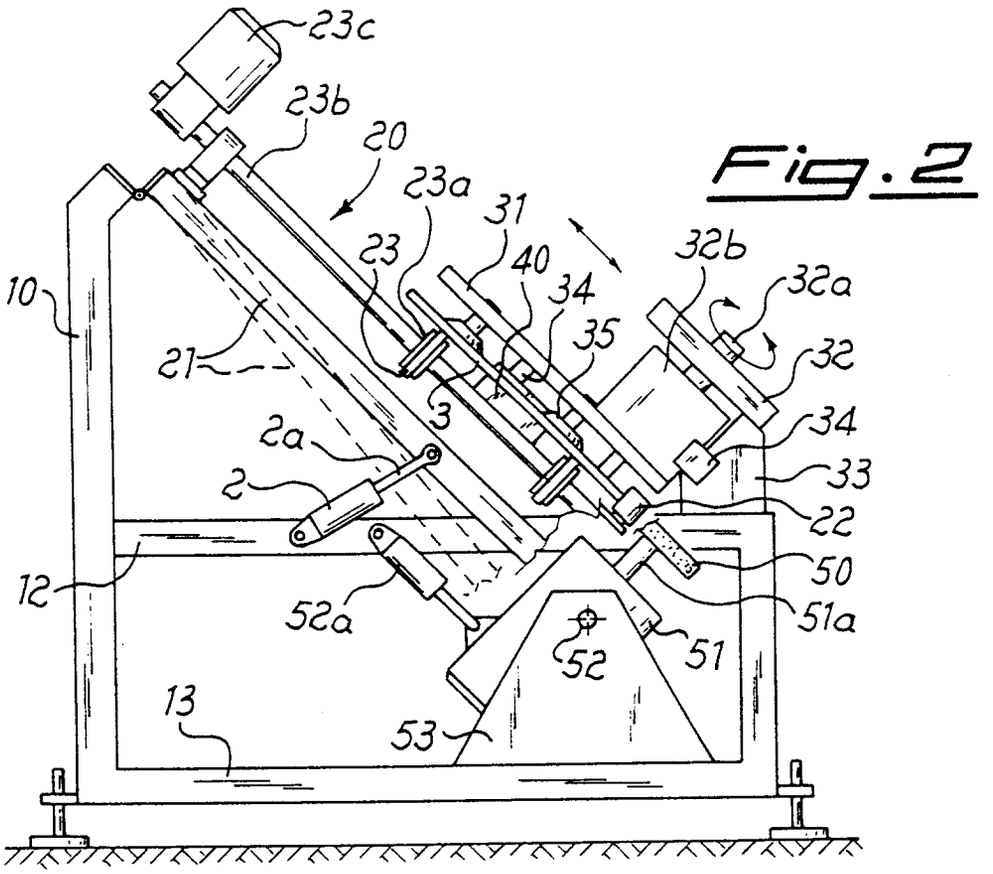
61
23d
3b
61a
22
51a
50
52
52
51
13
53
53

Fig.2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50
12
52a
51a
52
51
13
53